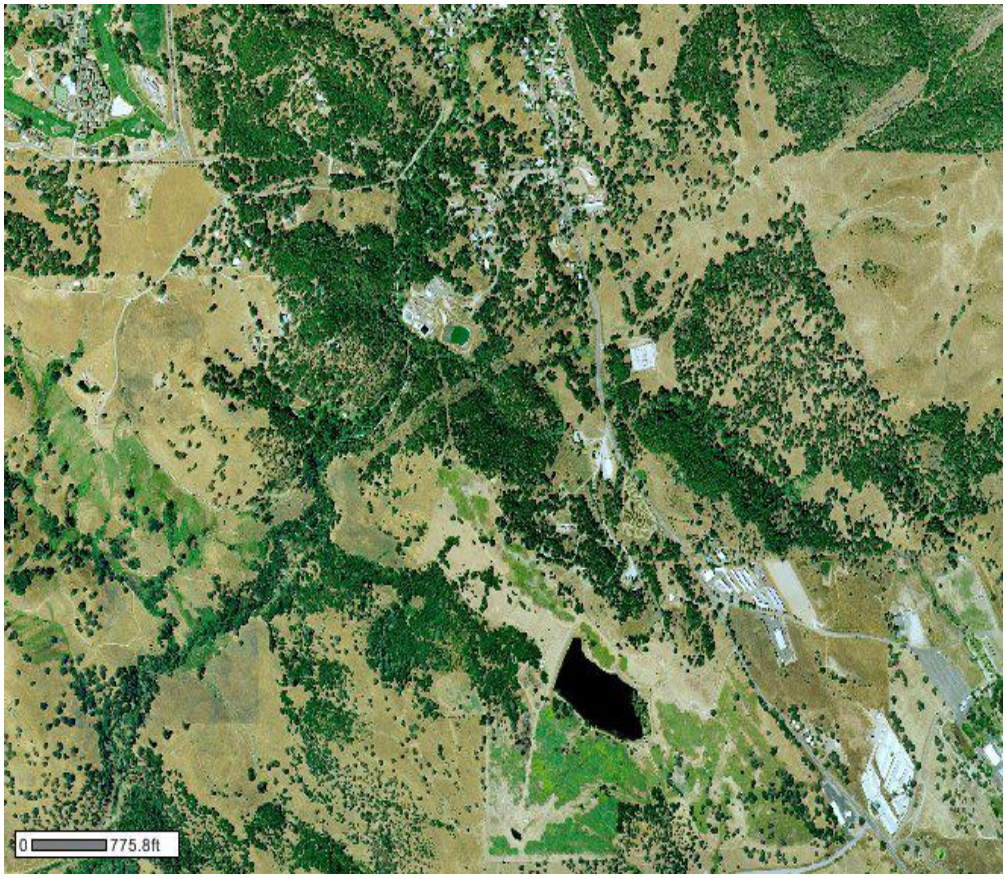
LONGTERM GROUNDWATER MONITORING PROGRAM



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City of Angels

City of Angels – Long Term Groundwater Monitoring Program

Section 1
Introduction and Background

1.1 INTRODUCTION

The City of Angels (also known as Angel's Camp) wastewater treatment and disposal facility (WWTP) is located within Calaveras County, City of Angels, California. The goal of this program is to develop long-term groundwater monitoring to evaluate potential impacts associated with wastewater treatment and disposal. Implementation of this program will provide adequate monitoring of surface water and groundwater down gradient of land used for tertiary treated wastewater disposal. This long-term groundwater and surface water monitoring program is recommended in order to document background variability in order to evaluate potential impacts (if any) associated with facility operations through comprehensive statistical analysis. The City of Angels has completed four quarters of monitoring and reporting with an initial anti-degradation report. The City of Angels will continue quarterly monitoring for a total of eight quarters with a second anti-degradation report to follow and continued semi-annual monitoring following the eighth quarter of monitoring.

1.2 SITE DESCRIPTION, GEOLOGY AND HYDROLOGY

The WWTP receives domestic and commercial sewage from the City. Current treatment includes mechanical screening, nitrification/denitrification, sand filtration, activated sludge treatment, and UV disinfection. The WWTP has a design capacity of 0.6 million gallons per day (mgd) average dry weather flow. Current average dry weather flows are .31 mgd. The plant operations include a 260 acre-foot storage reservoir (Hollman Reservoir) from which tertiary treated wastewater is discharged to one of two land application areas. The first is the City's sprayfields located on 61 acres pastureland less than 1 mile southeast of the WWTP. The second is 110 acres of golf course property at the Greenhorn Creek Golf Course located approximately 1 mile northwest of the WWTP. The discharges on City property are regulated by the WDR Order Nos. 98-110 and R5-2007-0031-01 (as amended by Order No. R5-2009-0074) adopted April 17, 1998 and August 13,2009 respectively. The discharges at Greenhorn Creek Golf Course are regulated by Order No. 98-110 adopted April 17, 1998 and Order No. 98-098 (Rev 2) issued Oct. 28,2011. Wastewater flows exceeding the WWTP land disposal and storage capacity are discharged seasonally under NPDES No.CA0085201 to Angels Creek, a tributary to the Stanislaus River. The WDR prohibits the degradation of groundwater and the exceedance of total coliform organisms at a concentration of 2.2 MPN/100 ml during any 7-day period.

The sprayfield site ranges in elevation from approximately 1,300 feet above mean sea level (msl) near the confluence of Six Mile Creek and Angels Creek near the north site boundary up to about 1,650 feet msl near the Re-Reg Pond located in the southwest corner of the site. Tertiary treated wastewater is either pumped or gravity fed from the Re-Reg Pond to the sprayfields. The rocks underling the sprayfields are primarily greenschist derived from porphyritic flows and flow breccia of Paleozoic and Mesozoic age. Paleozoic age metamorphosed sedimentary rocks of the Calaveras Complex are present east of the site and Jurassic age metamorphosed sedimentary and volcanic rocks are to the west. The Melones Fault Zone, a Mesozoic plate boundary separating Calaveras Complex rock to the east from metamorphosed sedimentary and volcanic rocks to the west, is mapped approximately one-half mile northeast of the site[1]. Groundwater was encountered in bedrock fractures at depths ranging from 70 to 80 feet during installation of wells MW-1 and MW-2. At least four springs are located in the sprayfield area. Groundwater gradient direction is estimated using measured groundwater depth-to-water in monitor wells, springs, and topographic features. The beneficial uses of underlying groundwater are domestic, industrial, and agricultural supply. Precipitation in the vicinity averages about 30 inches annually. Three

historic gold mines are present in the east of the sprayfields. These include the Marble Springs Mine, Bullion Mine, and Bruner Mines[2]. The presence of former underground mine workings may significantly influence groundwater occurrence and movement beneath the site.

1.3 MONITORING NETWORK

MW-1 is 80 feet deep and located in the north portion of the sprayfield area, in the assumed downgradient direction from land application areas and approximately 2,600 feet northwest of the Hollman Reservoir. The well screen elevation is at 1,174 to 1,189 bgs (68 to 83 feet below top of well casing). MW-2 is 100 feet deep and located in the east portion of the sprayfield area in the assumed upgradient direction from land application areas, and approximately 1,000 feet northeast of Hollman Reservoir. The well screen elevation is at 1,449 to 1,474 bgs (78 to 103 feet below top of well casing). The four site springs are labeled as Spring-1, Spring-2, Spring-3, and Spring-4. The Re-Reg Pond is located upgradient and approximately 750 feet west of Spring-2. These site features are shown on Figure 1.

1.4 WATER QUALITY REGULATORY FRAMEWORK

In order to comply with State Board Resolution 68-16, otherwise known as the "Antidegradation Policy", the City of Angels must evaluate potential impacts associated with the disposal of Tertiary treated wastewater and determine if the discharge is maintaining the "highest water quality consistent with the maximum benefit to the people of the State." In practice, this has meant that groundwater quality down gradient of wastewater disposal is evaluated with regards to conservative water quality goals (WQGs) and background groundwater quality. The background values are typically determined through statistical analysis of parameters measured in monitoring wells outside the influence of wastewater treatment and disposal, accounting for potential spatial variability at the site.

In the event that background values are of higher quality than the conservative WQGs, the WQGs become groundwater limitations. In this case, groundwater degradation may occur up to the groundwater limitations, provided that best practical treatment and control measures are being implemented, assuring the highest practical quality of effluent is achieved. If background groundwater values are of lesser quality than the WQGs, then background becomes the groundwater limitation. In this case, it is generally assumed that no assimilative capacity of the groundwater exists unless it can be demonstrated that certain beneficial uses of the water are or will not potentially be present at or in the vicinity of the site. For comparison, the conservative WQGs for common groundwater monitoring parameters at sites where effluent is disposed of to land are shown in Table 1-1.

Table 1-1
Conservative Water Quality Goals

Parameter	Parameter Water Quality Goal
pH	6.5 – 8.4 (a)
Specific Conductance (µS/cm)	700 (b)
Nitrate as N (mg/L)	10 (c)
Nitrite as N (mg/L)	1 (c)
Total Dissolved Solids (mg/L)	450 (b)
Total Coliform Organisms (MPN/100ml)	2.2 (a)
Arsenic (mg/L)	0.010 (c)
Barium (mg/L)	1 (c)
Boron (mg/L)	0.7 (b)
Iron (mg/L)	0.3 (d)
Manganese (mg/L)	0.05 (d)
Sodium (mg/L)	69 (b)
Chloride (mg/L)	106 (b)
Sulfate (mg/L)	250 (d)

a. Region 5 Basin Plan objective.
b. Agricultural water quality goal.
c. Primary Maximum Contaminant Limit.
d. Secondary Maximum Contaminant Limit.

Section 2
Sampling

2.1 GROUNDWATER SAMPLING

2.1.1 WATER LEVEL MEASUREMENTS

Depth to water measurement will be completed and recorded for all wells during sampling. Water level measurements will be taken with a calibrated electronic tape (sounder), and the same sounder will be used at all well monitoring locations to assure reproducibility of the results. Water levels will be recorded to the nearest 0.01 foot and will be referenced to the surveyed datum (north quadrant of the PVC well casing). Depth to groundwater measurements will then be converted to groundwater elevations and reported to the Regional Board.

2.1.2 NO-PURGE HYDRASLEEVE SAMPLING

No-purge HydraSleeve sampling methods will be used at the two monitor wells recently installed at the Sprayfields. The City's groundwater monitoring Consultant will provide trained personnel familiar with groundwater sampling methods and the HydraSleeve to perform sampling and analysis.

2.2 SPRING AND EFFLUENT SAMPLING

Grab samples of water collected directly from developed perennial springs (Spring-1, Spring-2, Spring-3, and Spring-4) and effluent (from the Re-Reg Pond) shall be assessed for the parameters identified in Table 2-1. These samples shall be collected and reported on a quarterly basis for a year (four quarters) and semi-annual basis thereafter. Following one year of monitoring, recommendations may be made by the City's Consultant to reduce the number of parameters or frequency of specific parameters assessed at both compliance and background monitoring locations. Springs that run dry will be reported as such to the Regional Board by the City of Angels and potential alternative monitoring locations assessed.

2.3 BACKGROUND SAMPLES

Previous Quarterly Reports and Sampling Data will be available from the City of Angels for use in establishing the background parameters for groundwater as well as surface water springs. Throughout monitoring, recommendations may be made by the City's Consultant to reduce the number of parameters or frequency of specific parameters assessed at both compliance and background monitoring locations.

2.4 QUALITY ASSURANCE/QUALITY CONTROL

All data collection will be in accordance with proper sampling and field measurement procedures as outlined below. The QA/QC program components for the field include:

* Decontamination of field sampling equipment
* Calibration of all field measuring equipment
* Sample logging and chain of custody procedures
* Sample labeling

* Ensuring that all samples are obtained, maintained, and shipped according to QA/QC procedures

All equipment used to obtain field measurements (pH meter, specific conductance meter, sounder *etc*.) will be calibrated according to manufacturer's directions prior to the beginning of each sampling event.

2.5 DECONTAMINATION

Non-dedicated sampling equipment will be cleaned by hand and on polyethylene sheeting or in contained bins. Cleaning will include:

1. If necessary, removing adhered soil particles by scrubbing with a hand brush in solution of potable water and a non-phosphate detergent (Alconox).
2. Rinsing with free-flowing potable, deionized, or distilled water.
3. Rinsing with chlorine solution prepared with potable, deionized, or distilled water.

Dedicated hand bailers will be rinsed with potable water. If this does not result in an acceptable cleansing of the bailer (e.g. soil particles adhere to the bailer), decontamination will follow that of non-dedicated equipment.

2.6 FIELD FORMS/SAMPLE IDENTIFICATION

All field forms for activities conducted during the sampling events will be maintained. Information concerning sample collection procedures, sample identification, and any other pertinent information or observations will be recorded on the field forms. Copies of the field forms will become part of the project file for further reference. Sample identification will be used to identify each sample location and sample type collected from the facility. This will provide a tracking mechanism to allow for retrieval of information and to insure that each sample is uniquely numbered. Sample identification will be provided on both the sample label and chain of custody and will consist of the following minimum information:

* Site identification;
* Sampler's initials;
* Applicable Preservatives;
* Date and time sampled; and,
* Sample location

2.7 SAMPLE SHIPMENT AND CHAIN OF CUSTODY

All samples collected for analytical testing will be delivered to an approved analytical laboratory within 48 hours of collection, or within method holding time, whichever is shortest. During sample shipment, samples will be kept on ice or synthetic substitute (e.g. "blue ice") in an insulated container at a maximum temperature of 4°C. A chain of custody record, which documents possession of samples from time of collection to laboratory analysis, will be maintained. Each person who has possession of the samples will complete applicable sections of the form when samples are received, relinquished and when sample possession is transferred. The chain of custody form will be sent in the shipping container along with the samples. The sample collector will have the receiving personnel of the laboratory sign the chain of custody form to complete documentation of sample possession from time of collection to delivery to the laboratory. The laboratory will provide a photocopy of this form for the sample collector's records.

References:
1. (Clark, et al., 1963)
2. (Bowen, et al., 1997; Jenkins, et al., 1955; Logan, et al., 1934)